DOCUMENT RESUME

ED 239 890 SE 043 846

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TITLE	Our Planet Earth. Teacher's Guide. Unit F1. ZIM-SCI, Zimbabwe Secondary School Science Project. Year 2.
INSTITUTION	Ministry of Education and Culture (Zimbabwe).; Zimbabwe Univ., Harare. Dept. of Curriculum Studies.
PUB DATE	May 82
NOTE	29p.; For study guide, see SE 043 845; for related documents, see SE 043 827-859.
AVAILABLE FROM	University of Zimbabwe, P.O. Box MP 167, Mount Pleasant, Harare, Zimbabwe.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Classification; Earth Science; General Science; *Geology; *Science Activities; Science Education; *Science Experiments; Science Programs; Secondary Education; *Secondary School Science; Soil Conservation; *Soil Science; Teaching Methods; *Trees; Units of Study
IDENTIFIERS	*Zimbabwe Secondary School Science Project

ABSTRACT

The Zimbabwe Secondary School Science Project (ZIM-SCI) developed student study guides, corresponding teaching guides, and science kits for a low-cost science course which could be taught during the first 2 years of secondary school without the aid of qualified teachers and conventional laboratories. This ZIM-SCI study guide presents activities, experiments, and field studies for a two-part unit in which students investigate: (1) the solar system; (2) structure and formation of the earth; (3) igneous, metamorphic, and sedimentary rocks; and (4) the nature and formation of soils. Characteristics of the major soil types found in Zimbabwe, trees characteristically associated with these soils, and soil conservation are stressed. Information to help students understand the scientific principles behind the activities, experiments, and field studies is provided. (JN)

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ZIM-SCI

ZIMBABWE SECONDARY SCHOOL SCIENCE PROJECT

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TEACHER'S GUIDE UNIT F1

Our Planet Earth

SE043 846

UNIVERSITY OF ZIMBABWE
AND MINISTRY OF EDUCATION AND CULTURE

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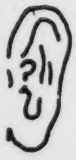
Acknowledgement: We are grateful for the ready co-operation and assistance we have received from the Audio Visual Department of the Ministry of Education and Culture in the preparation of art work.

May, 1982.

The following symbols will be used to indicate the points in the lesson at which teacher activity is particularly important. These symbols also appear at the corresponding points in the pupil study guides.

Practical work. The necessary instructions for each experiment will be given to you when you see this symbol.

Written exercises for the pupils. If possible these should be put on the blackboard before practical work begins so that the pupils can see what to look for.



Teacher information. The pupils will need extra guidance at these points. The information they will need from you is given where you see this symbol.

This symbol appears at a point where it is necessary for pupils to think over what they have done in the past few lessons. Set aside a period for this review activity. Encourage the pupils to read over their notes and the study guide section which they have just covered. It may be helpful to ask them to write a summary too.

The following symbols which appear only in the Teacher's Guide are used to indicate important points for you the teacher.

Take note of an important point.

This symbol indicates a preparation of apparatus which should be done well ahead of time. Please read these notes carefully and carry out the instructions well in advance.

We have placed this symbol next to experiments where we feel there may be a possible danger. Please read the section carefully so that you know about the particular danger in that experiment. It would also be wise to refresh your memory on the appropriate safety or first-aid procedures described in the Zim-Sci Handbook.

This symbol appears next to activities which are not experiments but involve pupils in observation and perhaps collecting information. An example is the field trip.

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AIMS OF THIS UNIT

When the pupils have completed this study unit they will be able to:

1. Describe the probable origin and structure of the earth.

2. Describe the general characteristics of igneous, metamorphic and sedimentary rocks.

3. Identify some rock specimens from their appearance.

4. Explain how soil is formed.

5. Demonstrate that soils are composed of solid particles of varying size.

6. Describe the general characteristics of clay, sand and humus and relate them to rock types.

7. Identify the clay/sand/humus proportion in a particular soil.

8. Relate soil characteristics to an ability to hold water.

9. Relate soil characteristics to fertility and agricultural use.

10. Identify some of the characteristic trees related to particular soil types.

11. Classify a particular soil in terms of its vegetation.

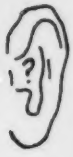
12. State reasons why soil conservation is important.

UNIT F1

PAGE 2 : LOOKING AROUND (ACTIVITY 1)

The general idea of the excursion outside is for the pupils to look at the earth and the sky and try to think seriously (perhaps for the first time) about the earth and its atmosphere.

You might like to read the following text to your class. Give them plenty of time to look around as you read and to supply them with some answers!



"Have a look around you as you stand outside. What lies under your feet? What is above you? What is all around you? Do you think that there is NOTHING around you, or do you think that the blue colour of the sky means that there is something up there? Bend down and look at the soil. Is it the same soil as you have at home? Is it the same soil that you might find in other parts of Zimbabwe? Who has seen other kinds of soil? Can you see any rocks? Are they the same colour as the soil, or do they look different? Pick up a small handful of soil. Are the pieces hard, or soft? Are they all the same size? The same colour?

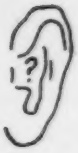
Probably you will be able to think of other interesting questions to ask the children which will make them look closely at their natural surroundings. Point out to them that the air is all around them even though they cannot see it. If they do not believe you, you could throw up a leaf or a feather and ask them to watch it floating down slowly as the air opposes its downward motion. They can also wave their hands in front of their faces and feel the air moving. Once you think they have observed well, they can return to the classroom and answer Exercise 1.

EXERCISE 1

1. The colour of the soil outside the classroom is ...

2. I observed / did not observe some rocks.

3. The colour of the rocks was ...



PAGE 4 : THE SOLAR SYSTEM

Please read this with your pupils, and ask them questions about how much they have learned before about the Solar System. Some may know quite a lot about it; others may know very little. It is not the intention of this part of the Unit to go very deeply into the arrangement of the planets. A broad idea will be fine.

PAGE 6 : EXPERIMENT 1 : MAKING A FLAMING BALL

You will need for each pair of pupils:

1 square aluminium foil (approx. 4"square)
3 spatulas potassium nitrate
2 spatulas sulphur
3 spatulas ammonium dichromate
1½ pieces filter paper
A piece of steel wool. (This should be a small piece pulled out to form a very thin net about the same size as the aluminium foil).
Some methylated spirits. This should be issued OUTSIDE after the pupils have made up the ball.

Please make sure that the pupils go outside for the last part of this experiment and that they do not stand their evaporating dishes close to anything which might catch fire. A sandy spot would be best. When the burning balls have completely cooled, pupils may return to the classroom.

They can clean their evaporating dishes with sand before washing them and drying them thoroughly.

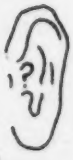
It would be a good idea if pupils wrote a REPORT of this experiment. In Form II, they should be writing reports after every experiment that they do!

There is a lot of reading for pupils to do at the beginning of this unit. Make sure they have enough time to do this and to think about what they are reading. You may need to help the weaker readers by reading the study guide with them.

PAGE 11 : LOOKING AT THE BIOSTRIP

Give pupils biostrip J H 110 so that they can look again at the first slide. They should be aware that algae are very small plants. You could point out the magnification to them again.

PAGE 12 : DISCUSSION ON FOSSILS



The main idea in this section is to help pupils realise that under rare conditions evidence of animals'or plants' existence can exist for millions of years. It is important that they understand that the process of turning living matter into fossils is unusual, otherwise there would be many more fossils, and that it takes a very long time.

You might care to read the following text to your pupils:

"When a living organism dies, it is soon broken down. Dead animals are eaten by other animals or are made rotten by the action of air and water. Plants are either eaten or changed into compost in the soil. The soft parts of an organism are broken down first. Hard parts, such as shells, bones and wood last longer and we sometimes find skeletons (such as zongororo rings) lying about. Even these will be broken down in the end."

"However, under certain conditions, the hard parts of living material can be preserved for millions of years! "Preserved"means that they are not destroyed. The result of this is called a fossil. You can see a picture of a fossilised leaf in your study guide. If a dead animal or plant is to be preserved (OR FOSSILISED) it must be surrounded straight away by substances such as sand, mud or even dust from a volcano. Water can also sometimes preserve organisms.

After a time, the mud, sand or dust changes into solid rock. Then the fossil too becomes part of the rock. Spaces in bones and wood also become filled up. Some dead trees in the Gokwe, Somabula and Sipolilo areas of Zimbabwe have been completely changed into rock which looks just like wood! It is only when you touch it that you realise that it is very hard. This change happened when the trees died and fell into water which contained no oxygen but many dissolved chemicals. Over thousands of years the chemicals took the place of the woody cells of the trees, ending up with a tree made of stone.
Are fossils of any use to us?
Scientifically they are very interesting because they tell us what life was like on earth many millions of years ago. "

MEASURING THE AGE OF ROCKS

In discussions about this section of F1, the children may ask you how we know the age of rocks and the earth itself. Here is some background information for you which may help you answer such questions:

Until the twentieth century the age of rocks could only be judged on a relative scale. This was done by observing carefully which rocks were formed first (those nearer the centre of the earth), which rocks contained the fossils of simple living things, and which contained fossils of more complex animals and plants. By this method it was possible to place different types of rock in order of age - from the oldest to the youngest. It was not possible however to give a real age in years.

Sedimentary rocks were formed by silt and small animals and plants forming layers under ancient seas and rivers. By estimating the growth rate of these layers the age of the sedimentary rock formed could be estimated. However, the figures obtained were only rough approximations and did not help very much.

Real answers to the ages of rocks and the earth itself had to wait for the discovery of radioactivity.

Radioactivity is the natural process through which atoms of certain elements break up into smaller atoms. These atoms which break up are usually the largest and a well known example is uranium.

Suppose we imagine 1 000 atoms of uranium in a box. After a time the process of radioactivity will have caused half of these atoms to break up into smaller atoms, so there will be 500 uranium atoms left in the box. After the same time again 250 atoms will be left. After the same time has passed again 125 atoms will be left and so on! The time required for half of the atoms of a radioactive element to break into smaller atoms is called its half-life. For uranium the half-life is about 4 500 million years. This has been measured by using special instruments to count atoms as they break up in a specimen of uranium which contains many millions of atoms.

Many rocks contain very small amounts of radioactive elements. To measure the age of such rock we need to find out how many of the smaller atoms found when a radioactive element breaks up are left in the rock now, and we need to know the radioactive element's half-life. We are then able to calculate how many 'half-lives' have passed since that element was mixed into the rock!

For example, if we found 500 of the smaller atoms which came from uranium in a particular rock then 4 500 million years ago there would have been 250 of these smaller atoms and 4 500 million years before that there would have been 125, and so on back to the time when there was only uranium in the rock and no smaller atoms which came from its break-up.

It is a very complicated calculation and radioactive elements other than uranium are often used, but the principle is the same and it has given us the true age of rocks, minerals and fossils found in the earth.

PAGE 17 : LAYERS OF EARTH

Some time ago, the inner iron core was thought to be liquid because of the high temperature at the centre of the earth. Recently, however, it has been calculated that the enormous pressure at the centre must push the iron particles so close together that they are in fact in the solid state.

PAGE 18 : CONVECTION CURRENTS IN THE MANTLE

Make sure that the children understand the meaning of "convection currents". Convection currents arise in liquids and gases when hot particles rise up and cooler particles move in to take their place. You can remind them of their paper spiral experiment in Unit B!

PAGE 21 : EXERCISE 2

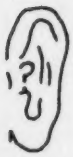
1. Copy the diagram of the earth's structure (Page 17). Label the layers as shown.
2. Write a brief imaginative composition on "The history of a rock". Pretend that you are a rock sticking out from the surface of the earth. How did you get there - and what have you seen in the millions of years since the earth began?

COMPARING DOLERITE AND GRANITE

The difference in density between dolerite and granite is not very large so pupils would need to use large samples in order to get an answer which is accurate enough to show the difference.

This will mean pupils will need to work in larger groups than is usual for Zim-Sci experiments. Try to make sure that the work is shared equally by all the pupils in each group.

PAGE 22 : DENSITY



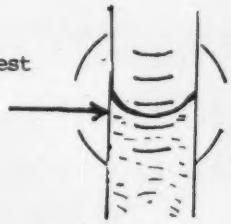
The aim of the discussion is to lead pupils to the idea that comparison of density must be done on a known VOLUME. Get the pupils' ideas on this and try if possible not to tell them too much.

You might like to read the following:

"If you take a bag of feathers and a cup of mealie meal you will not be able to tell whether feathers are heavier than mealie meal or not. You must take the same amount - a cup of feathers and a cup of mealie meal - to get the right result. For this reason we must take equal volumes when we make scientific measurements of density. Think back to Unit A1. How did you find the volume of beans? That is right - by dropping them into water. You are going to use the same method now to find the volume of a rock."

Remind pupils that the measuring cylinder has a meniscus which is read at the bottom:

Read here to nearest half a division.



Don't forget to insist on a report of the experiment!

Now return to the Study Guide. Please go through Pages 22 and 23 very slowly and carefully with the pupils.

PAGE 24 : EXPERIMENT 2 : LOOKING AT IGNEOUS ROCKS

You will need:

Handlers
Dropper
Balance
Measuring cylinder
Water
Samples of DOLERITE and GRANITE

It is easy to mix up the samples. TAKE CARE! Keep the labels and check that the samples are returned to the correct packets at the end. You will notice that the dolerite is a darker colour than the granite. This will assist you in re-packing. It would be a good idea to leave one piece of rock in each packet to match up.

PART 1: Pupils should see two different minerals in the dolerite and three in the granite. Check that you can see them for yourself. If they cannot pick out all the minerals it does not matter. They should make as careful an observation as they can.

PART 2: The difference in density between dolerite and granite is not very large so pupils would need to use large samples in order to get an answer which is accurate enough to show the difference.

This will mean pupils will need to work in larger groups than is usual for Zim-Sci experiments. Try to make sure that the work is shared equally by all the pupils in each group.

Pupils will require quite a few pieces of rock to obtain the required mass. Between five and ten pieces will probably be needed. Make sure that the balance is zeroed before they begin (use the screw at the back). They should try to read to the nearest half a division. This means that they are reading to 2½g instead of 5g. Perhaps they can make even better estimates? Maybe they can estimate to the nearest 1g? The more accurate their readings of mass and volume, the more accurate their density calculation will be.

PAGE 24 : EXERCISE 3

1: How many different minerals did you observe in the dolerite?
2: Write a short description of these minerals.
3: How many different minerals did you observe in the granite?
4: Write a short description of these minerals.
5: I guess the mantle rock is .....
6: I guess the crust rock is .....

PAGE 26 : EXERCISE 4

1: Mass of dolerite = g
2: Volume of water at first = 70cm^3
3: Volume of water and rock = cm^3
4: Therefore volume of rock = cm^3
5: Therefore 1cm^3 of dolerite had a mass of g
In other words, the DENSITY OF DOLERITE is g/cm^3
6: Mass of granite =
7: Volume of water at first = 70cm^3
8: " " water and rock = cm^3
9: Therefore volume of rock = cm^3
10: Therefore 1cm^3 of granite has a mass of g
In other words, the DENSITY OF GRANITE is g/cm^3
11: The ..... is the denser rock of the two.
12: The ..... is the mantle-like rock.
13: The ..... is the crust rock.

RESULTS expected for the experiment are:

1: Between 65 and 75g.
2: 70cm^3
3: About 90 - 100cm^3
4: 20 - 30cm^3
5: About 3g
i.e: the density of dolerite is ABOUT 3g/cm^3
6: Between 65 and 75g
7: 70cm^3
8: 90 - 100cm^3
9: 20 - 30cm^3
10: About 2½g
i.e: the density of granite is ABOUT 2½g/cm^3
11: Dolerite is the denser rock.
12: Dolerite is the mantle-like rock.
13: Granite is the crust rock.

PAGE 27 : EXPERIMENT 3 : SEDIMENTARY & METAMORPHIC ROCK

N.B.

Before pupils begin Experiment 3 make sure that all rocks from Experiment 2 have been returned to the correct packets.

Your pupils will need:

- Balance
- Measuring cylinder
- Water
- Samples of LIMESTONE & MARBLE
- Dilute hydrochloric acid prepared as follows:

To prepare dilute hydrochloric acid:
(Read this through carefully and completely before you begin).

Into a conical flask put 150 ml water. Using the 5ml measure, add 20ml concentrated hydrochloric acid to the water. Stir. Note:- Be very careful when measuring out the acid. ACIDS BURN THE SKIN. You must wash off any drops of acid on skin, clothes or desk with plenty of water. Try not to drop any! Wash the 5ml measure well when you have finished. DO NOT ALLOW PUPILS TO CARRY OUT THIS PART OF THE EXPERIMENT.

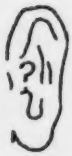
Read your handbook, pages 24, 25 to refresh your memory on acids.

Give each pair of pupils 5ml of your prepared dilute acid straight into their evaporating dish. Warn them of the dangers of acid on the skin and clothes. Make sure the safety bucket of water is handy throughout the experiment.

1: Pupils should not see different minerals in either of these rocks. However they will be able to see some crystals sparkling in the limestone. They may identify these as "different minerals". If they do, accept this judgement.

2: a: Pupils should see the marble and the limestone reacting with the acid to produce bubbles of gas. (This gas is in fact carbon dioxide). Do not allow them to leave the rocks in the acid for too long or they will be destroyed completely!

b: Pupils <u>should</u> get the <u>same</u> result for the density measurements on limestone and on marble. It will be a different value to the values obtained in Experiment 2 for dolerite and granite. (Probably in between them).



c: In fact Pupils will probably get slightly <u>different</u> answers for the density measurements. Help them to think about the <u>errors</u> in their measurements and suggest the slight differences are caused by the unavoidable errors in finding the volume and mass.

PAGE 28 : EXERCISE 5

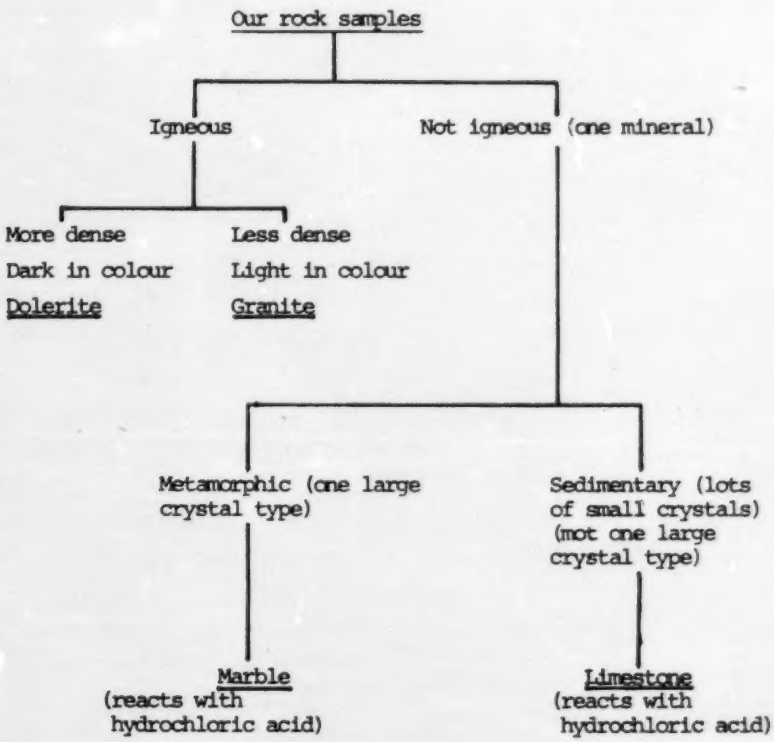
1: Briefly describe the appearance of the limestone and the marble. Try to mention everything you noticed after putting each rock into the acid.

2: Set out your density measurements exactly as you did for the granite and dolerite.

3: Do you think that your density measurements show that limestone and marble have the same density?

PAGE 29

Here is a suggested key for the rock samples provided:



PAGE 29 : ACTIVITY 2

You will need : Bioset ZS/1 "The Earth's History told in Rocks".

Bioviewers.

Pupils should spend one lesson studying the slides and reading the biosets. They can make notes if you wish. Perhaps you should allow them to examine their rocks again in order to compare them with the bioset slides. Refresh their memories of fossils - fossil leaves can be found at Wankie and are well known there.

PAGE 30 : ANSWERS TO "HOW MUCH DO YOU KNOW"

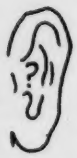
1: A fiery ball of gas and dust cooled to form the planets. The earth's crust was hot at first, with gases coming through it to form the atmosphere. The light rocks floated to the top to form the land. Steam condensed on the crust to form the sea. Living things began to grow, first simple plants and then animals. Man came last.

2: Diagram as in text, page 17.

3: Igneous, sedimentary, and metamorphic.
Differences in text, page 21.

4: The mantle rock would be more dense and darker in colour.

5: Addition of hot hydrochloric acid and release of gaseous bubbles.



HOW ROCKS GRADUALLY CHANGE

A common sight in many parts of Zimbabwe and particularly near Harare and in the Matopos Hills is a number of round rocks on top of a large rock. Often the rocks appear to have been carefully balanced one on top of the other.

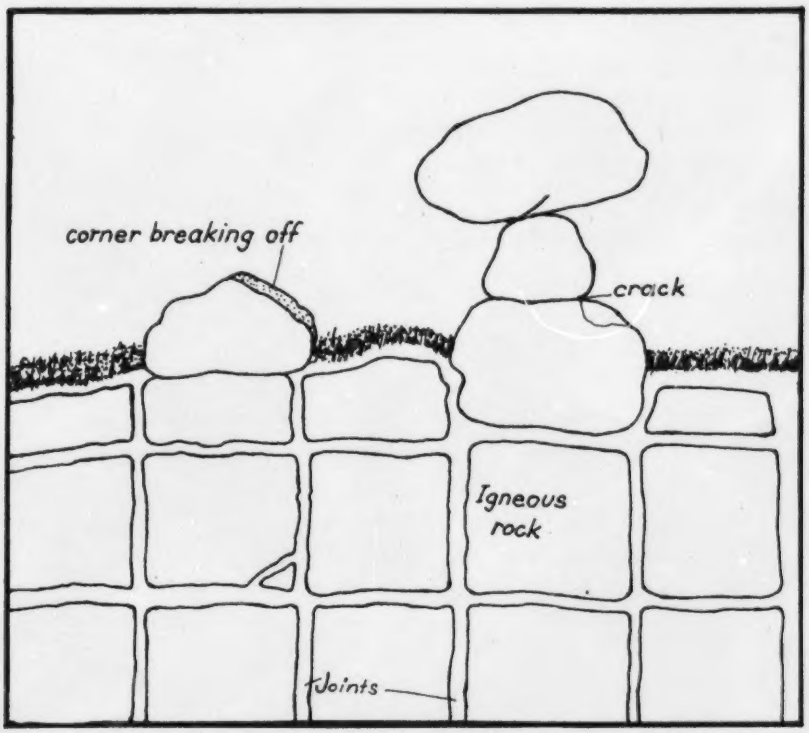
These balancing rocks are formed by a special kind of weathering. and form a useful introduction to the next part of this unit.

When the igneous rock of which they are made began to cool many millions of years ago the cooling was uneven causing the cracks to appear. These cracks broke the outer layers into rough blocks. The cracks near the surface were made bigger by rain falling much later in the evolution of the earth. The rain gradually washed away loose grains of rock until the blocks were quite separate and had rounded edges.

The exposed blocks were then alternately warmed by the sun causing them to expand and cooled at night causing them to contract. Most of the expansion and contraction took place on the 'corners' where the sun had its greatest effect and so these 'corners' gradually cracked and fell off resulting in round rocks resting upon each other as we see them today.

If you explain this to the children ask them to look around near the bottom of such rocks. They can often find the sharp edged 'corners' which have cracked off the rocks above.

You might like the children to heat an old piece of glass in their burner and cool it suddenly by placing it in water to illustrate the cracking process.



BALANCING ROCKS

PAGE 31 : PART 2. HOW DOES SOIL FORM?

In this part of the unit, pupils will be looking at samples of soil from your area. It would help them very much if you could locate at least two different soil types for them to test. The most important types for them to see are a clay and a sand. If you cannot locate these two types, the soil outside the classroom will do! Try to sample the soil in a place where there is some humus so that they can see this too.

(If the terms above are not familiar to you please read the study guide as they are explained there). If you have a friendly bus driver perhaps he can be persuaded to bring you soil od other types from a distant area!

PAGE 34 : EXERCISE 6

1: Explain WEATHERING
2: Describe a CLAY
3: Describe a SAND
4: What is a LOAM?
5: What is HUMUS?

Answers to Exercise 6 are all in the text

PAGE 35 : WHAT KIND OF SOIL DO YOU HAVE?

If you have been unable to collect suitable samples of clay and sand, pupils can collect soil from outside the classroom. If you have been successful, some could do soil experiments on the clay and some on the sand. Some should work with the local soil also. They can then compare results.

PAGE 35 : EXPERIMENT 4 : LOOKING AT SOIL

Your pupils will need:

soil
water
handlens

Pupils should see some of the humus floating on top of the water. They should also see air bubbles coming out of the soil when they pour on the water.

PAGE 35 : EXERCISE 7

1: The colour of my dry soil was .....
2: The colour of my wet soil was .....
3: Describe the appearance of your soil.
Mention any larger rock pieces and their colour.
4: When I added water I observed .....

PAGE 36 : EXPERIMENT 5. FEELING SOIL WITH THE FINGERS.

Your pupils will need:

Soil
Water

Do not let the pupils make their soil too wet at first. If the soil is a clay, it will not make a good ball if it is too wet. Pupils can repeat the experiment if they have not been able to decide their soil type the first time.

PAGE 38 : EXPERIMENT 6 : MORE ABOUT SOIL

Your pupils will need

soil

water

Make sure that the beakers are graduated. If they are not, pupils should re-graduate them before doing the experiment. See Unit A1.

It is most important that the pouring off of the clay fraction is done carefully. If pupils pour too fast, some of the sand fraction will be carried over. If they are too slow, some of the clay will settle and will be difficult to wash out with five or six washings. Thus steps 2 and 3 are very important.

Pupils must keep the sand fraction in the graduated beaker for the next experiment, (Experiment 7).

PAGE 40 : EXERCISE 8

1: Volume of soil at beginning = 25 ml.

2: Volume of sand part =

3: Therefore volume of clay part =

4: My soil was mostly clay/sand?

ANSWERS TO EXERCISE 8

Pupils will find that the sand volume varies with the type of soil. If it is a clay, the sand fraction may be very small indeed. If about half, they should decide that they have a loam. If the sand fraction is larger, the soil is a sand.

PAGE 41 : EXPERIMENT 7: LOOKING AT SAND

Pupils will need

handlens

magnet

Magnetic qualities vary across the country. Dolerites tend to have quite a lot of magnetic particles. If your pupils find a large magnetic fraction, can you relate this to the frequency of lightning strikes in your area? Can you suggest areas which are of different soil type (grey soil for example) where lightning strikes might be less? Would this be a better place to put a village?

PAGE 41 : EXERCISE 9

Describe the appearance of the sand part of your soil.
Record the results of your observation with the magnet.

PAGE 41 : EXPERIMENT 8 : HOW WELL DOES THE SOIL HOLD WATER?

Pupils will need:

- balance
- soil
- water

If there is a smell while the pupils are heating the soil, it will be burning humus that they can smell.

PAGE 44 : DISCUSSION AFTER EXPERIMENT IS COMPLETE

This experiment is a very rough one. The reason for wetting the soil until it is saturated with water is that the soil will not be uniformly wet to start with. The amount of moisture it has in it already will depend on the climate at the time. Thus the idea of the experiment is to make the soil as wet as possible, and then to drive off the water. It would be better to do the experiment the other way round: that is, to dry the soil first, and then to add water until the soil just appeared wet. It would be a useful exercise for the pupils to try both the method given in the study guide and the "reverse". That is, after they have dried it, add water again until it appears to be just wet on the surface and weigh "soil and water" once more. Is their result different the second time? Which way do they think is best? In soil laboratories the soil is "air-dried" for many days and then water is added until the soil appears just wet. Pupils might like to try other methods of measurement if they can think of other ways. Encourage experimentatation outside the recommendations of this course!

PAGE 44 : EXPERIMENT 9 : AIR IN THE SOIL

You will need:

spatula
soil
water
2 measuring cylinders.

You should do this experiment for the pupils.

1: Add 50ml soil to the first measuring cylinder. DO NOT SQUASH IT DOWN.

2: Add 50 ml water to the second measuring cylinder.

Ask the pupils what the combined volume should be. Then add the water to the soil. You may stir, or wait for some time until all the soil is wet from top to bottom. The combined volume should be much less than expected! The escaping air should be observed clearly by the pupils (as bubbles in the water). The water fills up the spaces previously occupied by the air.

PAGE 44 : EXERCISE 11

1: Volume of soil + air held by soil = ($50cm^3$)

2: Volume of water = ($50cm^3$)

3: Combined volume (soil+water) = cm^3

4: Therefore volume of air held by soil = cm^3

5: Therefore % air in soil = %

PAGE 44 : TREES AND SOIL TYPES

The indigenous trees which grow in Zimbabwe are often a good indication of the soil below the trees. The pupils will probably be able to tell you many different kinds of trees in your area. It is only when many trees of one kind are observed that their presence becomes a significant indication of soil type.

PAGES 48 AND 49 : TABLES 1 & 2

N. B.

Please make sure pupils copy the tables into their books before making crosses!
Pupils should make a cross in any square whose result is similar to the ones they have obtained for themselves. Use of a different coloured pencil for their crosses would help.

PAGE 49 : EXERCISE 12

Describe your soil using Tables 1 & 2 to help you.
What kind of soil do you think you have?

PAGE 50 : ACTIVITY 3 : THE FIELD STUDY

The aim of the field study is to teach the children three things:

1: To observe their surroundings
2: To make a plant and animal count
3: To understand the importance of soil conservation

Of the three, the last is perhaps the most important. Choose an area of study that is about 5m square. It should be a well-vegetated area, preferably with one tree. Try not to choose an area with garden lawn grass. An area of natural bush vegetation would be best.

1: Pupils should try to discover the depth of soil in the chosen area. If it is more than 50cm thick they do not have to go on and on digging! A rough idea will be fine. Explain to the students that the depth of soil is important for the existence of plant and small animal life.
2: Pupils should try to estimate the number of plants in the chosen area. They can do this by counting in a small part of the area and multiplying up to get the total. For example, the large area could be five paces each way and the area chosen for counting could be one pace square.

If there are very few plants, can they explain why? (They should think about the type of soil and its depth when they look at the amount of vegetation). Are there fewer plants under the tree? Why? (Remind them of Unit E2 and the idea of competition!). If the soil is good, try to walk outside the area until there seems to be less vegetation than before. Can they find a reason for the change?

3: Pupils should examine the whole of the chosen area for small animal life. Are there ants? Beetles? Worms? If there is little to be found, why? Perhaps poor vegetation and lack of animal life go together? Is this a bad sign?

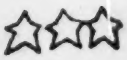
4: Lastly, try to take your pupils to a hill or kopje. You should find patterns of soil erosion on the hill. The vegetation should follow these patterns. You may also find a change in soil colour from the top to the bottom, as the rainfall pattern varies down the hill. Again, vegetation will vary with soil type. Do they think that bush fires will have an effect on vegetation?

You may be able to find a cutting or a quarry where pupils can see a SOIL PROFILE. The diagram on page 50 in the study guide is of a possible soil profile. The ones in your area may be different. If you are lucky enough to find a cutting, can pupils see a difference in soil colour as a result of rain water washing chemicals down into lower levels?

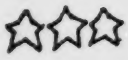
N. B.

It will be most useful if you can make the point CONSTANTLY to your pupils that a good, rich soil cover leads to good vegetation (and crops). In the future, Zimbabwe will need to use her soil more and more. The pupils should learn that ways of conserving soil are:

1: Keeping a good plant cover
2: Placing rocks and stones to prevent erosion
3: Returning to the soil the things which man removes (by means of compost, fertilisers etc.)
4: Sensible use of the soil by crop rotation.



REMEMBER: Our soil is our LIFELINE!



Printed by the Government Printer
Harare